Paper No. 17

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

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Ex parte AJIT P. PARANJPE

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Appeal No. 1999-1655
Application No. 08/722,904

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ON BRIEF

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Before THOMAS, KRASS, and DIXON, **Administrative Patent Judges**.

DIXON, **Administrative Patent Judge**.

DECISION ON APPEAL

This is a decision on appeal from the examiner's final rejection of claims 1-4. Claim 5 is directed to a non-elected invention. Claims 1-5 are all of the claims pending in this application.

We AFFIRM-IN-PART.

BACKGROUND

The appellant's invention relates to an integrated circuit interconnect. The invention uses ion implantation and annealing to encapsulate the vertical sidewalls of a clad metal structure or trench in a dielectric material. An understanding of the invention can be derived from a reading of exemplary claims 1 and 3, which are reproduced below.

> 1. A method of encapsulating clad metal structures in an integrated circuit, comprising the steps of:
>
> (a) providing a partially formed integrated circuit with a clad metal structure including a first metal structure and a cladding metal on a top horizontal surface of the first metal; and
>
> (b) implanting dopants into exopsed [sic; exposed] first metal vertical sidewalls of said clad metal structure to form vertical surface regions of first metal-dopant mixtures.
>
> 3. A method of encapsulating metal structures in an integrated circuit, comprising the steps of:
>
> (a) providing a partially formed integrated circuit with a dielectric layer including trenches;
>
> (b) implanting dopants into surface regions of sidewalls of said trenches;
>
> (c) filling said trences [sic; trenches] with metal to form metal structures with said dopants adjacent said metal structures; and
>
> (d) after said filling with metal, annealing said metal structure and dielectric with said implanted dopants to form metal surface regions of metal-dopant compounds.

The prior art references of record relied upon by the examiner in rejecting the appealed claims are:

Gelatos et al. (Gelatos)	5,391,517	Feb. 21, 1995
Choi	5,670,420	Sep. 23, 1997 (Filed Nov. 8, 1995)

Claims 1-4 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite in that a word is clearly misspelled in each of the independent claims 1 and 3. Claims 1-4 stand rejected under 35 U.S.C. § 103 as being unpatentable over Choi in view of Gelatos.

Rather than reiterate the conflicting viewpoints advanced by the examiner and the appellant regarding the above-noted rejections, we make reference to the examiner's answer (Paper No. 11, mailed Dec. 22, 1998) for the examiner's reasoning in support of the rejections, and to the appellant's brief (Paper No. 10, filed Oct. 8, 1998) and reply brief (Paper No. 12, filed Jan. 8, 1999) for the appellant's arguments thereagainst.

OPINION

In reaching our decision in this appeal, we have given careful consideration to the appellant's specification and claims, to the applied prior art references, and to the respective positions articulated by the appellant and the examiner. As a consequence of our review, we make the determinations which follow.

35 U.S.C. § 112, SECOND PARAGRAPH

Here, the examiner maintains that the presence of a single misspelled word in each of the independent claims that makes the claims indefinite under 35 U.S.C. § 112, second paragraph, and therefore lacks particularity and distinctness with respect to the claimed invention. We disagree with the examiner. Here, the scope and content of the claims are clear, and the examiner even provided the correct spelling in the office action. Therefore we find that these errors in the claims do not form an appropriate basis for a rejection under the statute, but the examiner may consider an objection under 37 CFR 1.75(a) or correct the obvious typographical errors by examiner's amendment. Therefore, we will not sustain the rejection of claims 1-4 under 35 U.S.C. § 112, second paragraph.

35 U.S.C. § 103

"To reject claims in an application under section 103, an examiner must show an unrebutted ***prima facie*** case of obviousness. **See In re Deuel**, 51 F.3d 1552, 1557, 34 USPQ2d 1210, 1214 (Fed. Cir. 1995). In the absence of a proper ***prima facie*** case of obviousness, an applicant who complies with the other statutory requirements is entitled to a patent. **See In re Oetiker**, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). On appeal to the Board, an applicant can overcome a rejection by showing insufficient evidence of ***prima facie*** obviousness or by rebutting the ***prima facie*** case with

evidence of secondary indicia of nonobviousness." **In re Rouffet**, 149 F.3d 1350, 1355, 47 USPQ2d 1453, 1455 (CAFC 1998). Here, we agree with the examiner's rejection of independent claim 3, and we find that appellant has not overcome the ***prima facie*** case of obviousness by showing insufficient evidence by the examiner nor has appellant provided evidence of secondary indicia of nonobviousness. But, we agree with appellant that the examiner's rejection lacks support for the invention as recited in claim 1. Therefore, we find that appellant has overcome the ***prima facie*** case of obviousness by showing insufficient evidence by the examiner with respect to independent claim 1.

With respect to independent claim 1, the examiner maintains that "implanting dopants into exposed first metal vertical sidewalls of said clad metal structure to form vertical surface regions of first metal-dopant mixtures '6' ([Choi at] col. 2, lines 24-30)" provide support for step (b) of claim 1. (See answer at page 3.) We disagree with the examiner. Appellant argues that Choi does not teach or suggest the concept of implanting dopants into exposed sidewalls of the clad metal structure to form vertical surface regions of first metal-doped mixtures. (See brief at page 4.) We agree with appellant. Appellant argues that the combination of Gelatos with Choi does not teach or suggest the invention of claim 1. (See brief at page 4.) We agree with appellant.

From our understanding of Choi, the third tungsten film 6 is formed "by a selective deposition method so as to prevent the metal interconnection oxidizing due to an exposure

in an atmosphere." (See Choi at col.2, lines 26-29.) From the specific teachings of Choi with respect to the formation of the layers and the specific processes used for each layer, it is unreasonable for the examiner to maintain that the third tungsten layer/film 6 is formed by ion implantation. Here, Choi specifically teaches deposition for layer 6 as opposed to the ion implantation which is specifically taught for layers 2 and 4. The examiner has not maintained that these methodologies are equivalent or that one is obvious in light of the other. The examiner merely maintains that Choi teaches ion implantation for the vertical surface regions. We disagree with the examiner and will not sustain the rejection of claim 1. With respect to claim 2 appellant argues that the combination of Choi and Gelatos does not anneal the dopants in the sidewalls. (See brief at page 4.) We agree with appellant and will not sustain the rejection of dependent claim 2.

With respect to independent claim 3, the examiner relies on Fig. 2 of Choi for the teachings of ion implantation to improve the adhesion to the trench. Here, we note that the first layer of tungsten 2 is formed by ion implantation in the trench in an oxide layer 1. The examiner maintains that layer 1 is a dielectric layer. We agree with the examiner that the oxide layer may be a dielectric layer with trenches therein. (See answer at page 3.) The trenches are then filled with copper.

The examiner maintains that Choi does not teach the annealing of tungsten and metal after the trench is filled. (See answer at page 3.) We note that Choi teaches annealing

after the ion implantation of the tungsten rather than after deposition of copper. (Choi at col. 2.) The examiner relies upon the teachings of Gelatos with respect to annealing multiple layers to form intermetallic layers to promote superior adhesion and this would have been desirable in the formation of Choi. (See answer at page 3.) We agree with the examiner.

At page 5 of the brief, Appellant recites the steps of claim 3 and argues neither Choi or Gelatos nor any proper combination of these references teaches or suggests the claimed limitations. We disagree with appellant. In the answer, the examiner has identified the relevant teachings in the prior art references and provided a motivation for the combination which appellant has not adequately rebutted. Therefore, we will sustain the examiner rejection of independent claim 3, and since Choi also discloses the limitation recited in dependent claim 4, we will sustain this rejection also.

CONCLUSION

To summarize, the decision of the examiner to reject claims 1-4 under 35 U.S.C. § 112, second paragraph is reversed; the decision of the examiner to reject claims 1 and 2 under 35 U.S.C. § 103 is reversed, and the decision of the examiner to reject claims 3 and 4 under 35 U.S.C. § 103 is affirmed.

AFFIRMED-IN-PART

JAMES D. THOMAS Administrative Patent Judge	)))))) BOARD OF PATENT
ERROL A. KRASS Administrative Patent Judge	) APPEALS) AND) INTERFERENCES
JOSEPH L. DIXON Administrative Patent Judge	))))

JD/RWK

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